(APPENDIX)

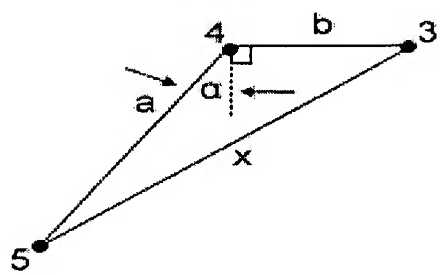
Sample Mathematical Algorithm For Determining Horizontal Deviation

The following dimensions can be obtained from a given hoist traveling trolley as shown in FIG. 1:

- a : the length of two supporting cables 10a and 10b,
- b : the span between the two cables 10a and 10b.

The variable lengths of cables 8 and 9 in FIG. 1 can be obtained respectively from the length sensors 3 and 4. We refer them respectively herein as variables "x" and "y".

When the system is in a status as shown in FIG. 2, it can be illustrate with the following schematic diagram:



We now calculate one of the mathematical algorithms using, for example, the law of cosine which is well known in the art. For example, below is shown the mathematical relationship between the angle of deviation "α" and the length "x" detected from length sensor 3.

$$x^2 = a^2 + b^2 - 2ab \cos(\alpha + 90°) \quad : \text{ the law of cosine}$$

$$\cos(\alpha + 90°) = \frac{x^2 - a^2 - b^2}{-2ab}$$

$$\alpha + 90° = \cos^{-1}\left(\frac{x^2 - a^2 - b^2}{-2ab}\right)$$

$$\alpha = \cos^{-1}\left(\frac{x^2 - a^2 - b^2}{-2ab}\right) - 90°$$

The mathematical relationship between the angle of deviation "α" and the length "y" detected from length sensor 4 can be drawn in a similar manner as discussed above.

The deviation "A" can also be easily calculated as below from the deviation angle "α" from simple trigonometry law:

$$A = a \sin \alpha$$